



GPS Policy, Management & Modernization

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OVERVIEW

- **Background & Policy**
- **Management Structure**
- **System Status & Modernization**
- **Interagency Projects**
- **Summary**

- **Management Structure**
- **System Status & Modernization**

Background & Policy

- **Interagency Projects**
- **Summary**





GPS Background

- **Active program for 30 years**
 - Created from separate programs in 1973
 - Developmental satellites began launch in 1978; operational satellites in 1989
 - Initial Operational Capability in 1993; Full Operational Capability in 1995
- **Designed as a dual-use system**
 - Military applications for US and Allied use
 - Civilian applications for worldwide use
- **Consistent U.S. National Policy** from both Executive and Legislative branches
 - Presidential Decision Directive - March 1996
 - U.S. Public Law - December 1997
- **IGEB to manage GPS as a national asset** -- increases user trust in GPS as a dual-use system



GPS is a Clear “Public Good”

- GPS services are like a “super lighthouse”
 - That the U.S. built and provides for free
- GPS receivers are like AM/FM radios
 - Without advertising
- GPS is not a public utility or like cable TV
 - Hard to meter, no hard connection required
 - Marginal direct cost of a user is zero
- Even a “private” organization would need government powers or assistance
 - To collect fees
 - Liability shield for safety of life uses



Policy Principles

- **No direct user fees** for civil GPS services
- **Protect** the current radionavigation spectrum **from disruption and interference**
- **Open public signal structure** for all civil services
 - Promotes equal access for user equipment manufacture, applications development and value-added services
 - Ensures **open market** driven competition
- Use of GPS time, geodesy, and signal **standards**
- **Global compatibility & interoperability** of future systems with GPS
- Recognition of **national and international security** issues and protecting against misuse



International Cooperation Summary

- **U.S. goals**
 - Support GPS Policy Principles
 - Promote Peaceful Civil, Commercial, & Scientific Uses of GPS Worldwide
- US is continuing to work with interested nations on the adoption of safety-of-life augmentations
- US is cooperating with **Japan** in developing the QZSS under the auspices of the 1998 US-Japan Joint Statement
- No recent discussions with **Russia**
- Negotiations with the European Commission on **Galileo** continue
 - Progress is being made on signal structures compatible with **National Security**
 - Other contentious issues are also being addressed and an overall **cooperative agreement is nearing completion**

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GPS Management

DoD Positioning, Navigation, and Timing (PNT) Exec Committee (DoD POS/NAV Ex Com)

Charter: Primary advisory body to ASD/C3I on DoD Position, Navigation & Timing (PNT) Matters; Primarily used as a staffing mechanism for DoD coordination;

PNT Working Group (WG)

Charter: Subordinate group to Ex Com

Interagency GPS Executive Board (IGEB)

Charter: Senior-level; manages GPS & US Augmentations, consistent w/ National Policy; Protect national security and foreign policy interests; Focus on dual use aspects

IGEB Senior Steering Group (SSG)

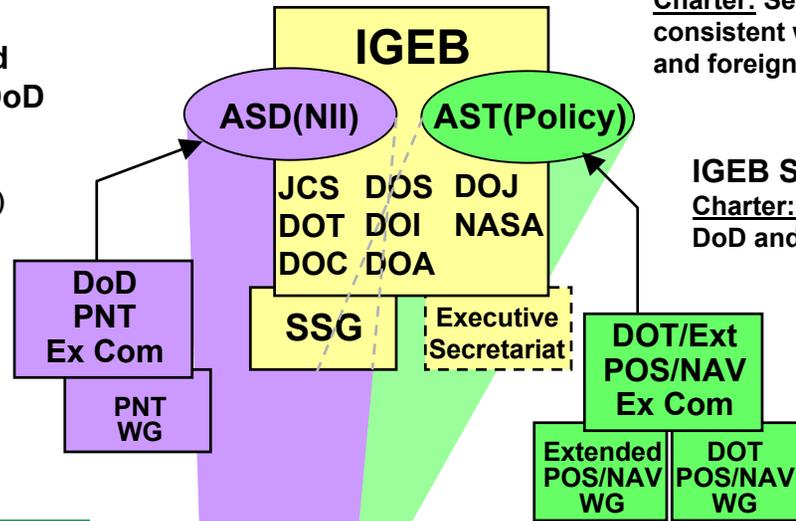
Charter: Advisory body to IGEB; Co-chaired by DoD and DOT

DOT/Extended POS/NAV Executive Committee

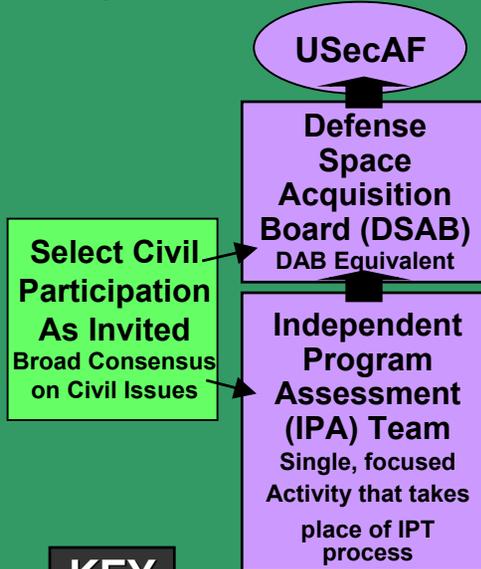
Charter: Primary advisory body to DOT on civil PNT matters;

Extended and DOT POS/NAV WGs

Charter: Provide broad civil input on PNT matters that extend beyond just transportation;



Acquisition Process



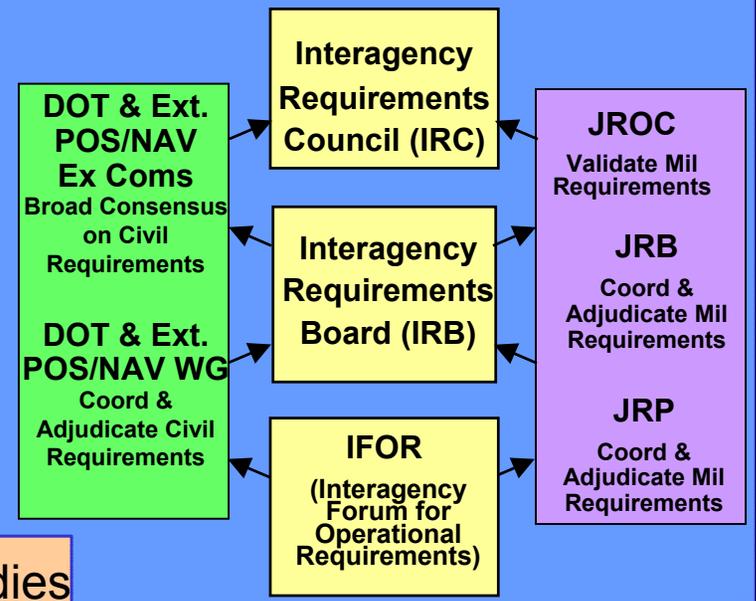
KEY

- DoD Only
- Interagency
- Civil Only
- Independent



Independent Advisory Bodies

Interagency Requirements Process





Interagency GPS Executive Board

- U.S. GPS Policy of 1996 called for a permanent Interagency GPS Executive Board (IGEB) to manage GPS and its federal augmentations
 - Recognizes **dual-use** nature of GPS
 - Provides **national perspective on policy** matters
 - Promotes international acceptance of GPS as a global positioning, navigation & timing “public good”
- **IGEB charter** signed by Secretaries of Defense and Transportation in early **1997**
- IGEB recognized by Public Law

IGEB has met 11 times since 1st meeting in 1997



MEMBERSHIP

Defense



Transportation

Commerce



State

Interior



Agriculture

**Joint Chiefs
of Staff**



NASA



IGEB STRUCTURE

Defense
Pos/Nav/Time WG
Transportation
Pos/Nav WG



**IGEB
Co-chairs &
Principals**

**Independent
Assessment
Team**



Civil GPS
Service
Interface
Committee

**Senior Steering
Group** / **Executive
Secretariat**

**GPS Int'l
Working
Group**

**Ad Hoc
Working
Groups**

**GPS System
Engineering
Forum**



IGEB Member Agency Representatives



Senior Steering Group (SSG)/ Executive Secretariat

- **SSG** established in 2000 to facilitate IGEB decision making without continuous involvement of principals
 - Prepares recommendations for the IGEB
 - Empowered to make decisions as necessary
 - Oversees **Stewardship Funding** process
 - Membership includes Exec Sec Director, delegates of IGEB Principals & additional representatives from operating agencies
- **Executive Secretariat** established in 1999 at the Dept. of Commerce and staffed by IGEB agency representatives
 - Tracks GPS & augmentation programs and policy matters, identifies issues, facilitates policy discussions, and administers ad hoc working groups
 - Coordinates & disseminates information among IGEB agencies
 - Provides administrative support to IGEB, including administration of the **GPS Stewardship Fund**



Independent Assessment Team (IAT) & GPS International Working Group (GIWG)

- **IAT** provides independent assessments on all aspects of satellite-based positioning and timing services to improve service and ensure a balance between National Security, Civil, Commercial, and Scientific equities
 - GPS & Modernization plans for GPS
 - Fielding and modernization of GPS augmentations
 - Members with satellite navigation expertise are drawn from industry, academia, and prior government service
- **GIWG** is led by the State Department and is responsible for GPS and augmentation international cooperation
 - Outreach missions, exhibits, venues
 - Bi-lateral and multi-lateral international Satellite Navigation discussions and meetings such as:
 - UN Activities
 - Japan/US/ & EC/US Consultations
 - Other regional/national Consultations



GPS System Engineering Forum (GSEF) & Ad Hoc Working Groups

- **GSEF** established in 2002 to provide a forum for discussion of system engineering issues relative to GPS and GPS augmentations that influence or are influenced by managerial and policy decisions
 - Co-chaired by the Air Force and FAA
 - Accepts tasking from the IGEB for resolution of GPS and/or augmentation system engineering issues
 - Issues will be framed for decision by the IGEB in consultation with responsible Air Force and FAA/Coast Guard system development authorities
- **Ad Hoc Working Groups (examples)**
 - L5 Compatibility
 - GPS Spectrum Defense
 - GPS Timing
 - GPS Public Outreach

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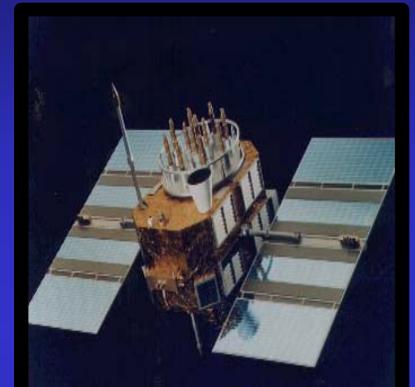




GPS Constellation Status

27 Operating Satellites (to ensure 24)

- **18 Block II/IIA** satellites operational
- **9 Block IIR** satellites operational
 - 11 of 21 Block IIR satellites available
 - Modernizing up to 8 Block IIR satellites
 - Most recent launch: 22 Dec 03 (SVN 47)
- **Next Launch:** 20 Mar 04 (GPS IIR-11)
- **Continuously assessing** constellation health to determine launch need
- Global civil service **performance commitment** has been met continuously since Dec 93





Constellation Performance

January 1-September 11, 2002

Specification values from the Standard Positioning Service Performance Standard, October, 2001

PDOP Availability

Specification - PDOP of 6 or Less, 98% of the time

Actual - 99.9%

Horizontal Service Availability

Specification - 95% Threshold of 36 meters, 99% of the Time

Actual – 3.53 meters

Vertical Service Availability

Specification - 95% Threshold of 77 meters, 99% of the Time or Better

Actual – 5.01 meters

User Range Error

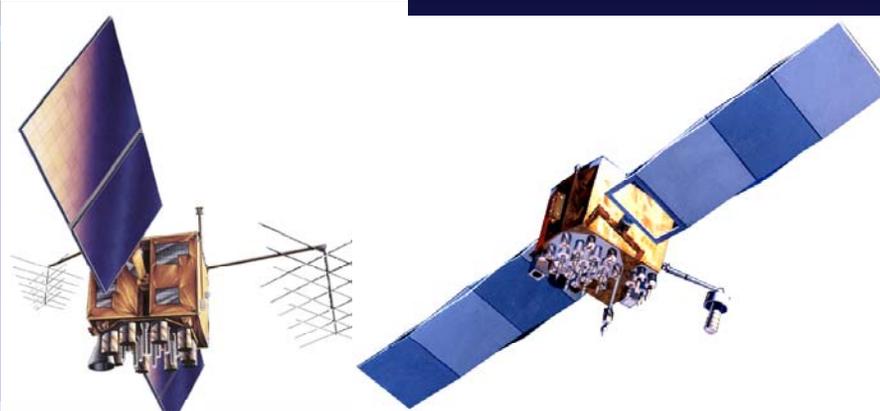
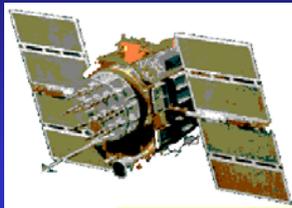
Specification - 6 meters or Less, Constellation Average

Actual - 1.43 meters

System accuracy and availability far exceed current specifications, but not current requirements



GPS Modernization Plan



Increasing System Capabilities ♦ **Increasing Defense/Civil Benefit**

Block II A/IIR

- Basic GPS
- Std Service (36m/77m/40 ns horizontal/vertical/time)
 - Single frequency (L1)
 - Coarse acquisition (C/A) code navigation
- Precise Service (3.7m/5.3m)
 - Two frequencies (L1 & L2)
 - P-code navigation

Block IIR-M, IIF

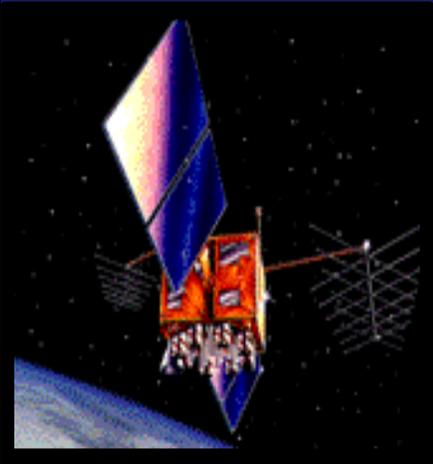
- IIR-M**: IIA/IIR capabilities plus
- 2nd civil signal (L2C)
 - Earth coverage military code
 - Basic anti-jam power (+7dB)
- IIF**: IIR-M capability plus
- 3rd civil signal (L5)

Block III

- Evolutionary acquisition:**
- Increased anti-jam power (+20dB)
 - Increased accuracy (1.2m/4.8m)
 - Satellite Crosslinks
 - Controlled integrity
 - Backward compatibility
 - Increased security
 - Assured availability
 - System survivability



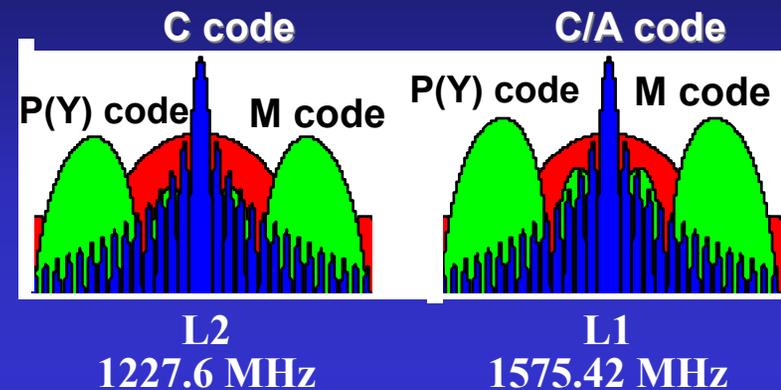
Summary of Signal Modernization



Block IIRs (8 SV's)

- Adds L2C
- Adds new military M-Code

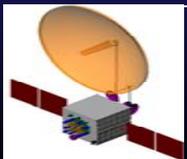
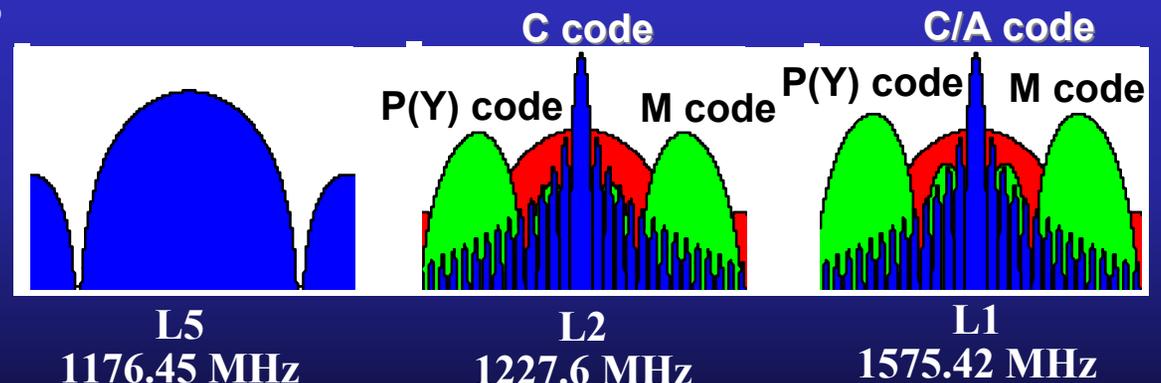
Signals in Space



Block IIF (16 SVs)

Adds civil L5

Signals in Space



- GPS III Architecture Studies underway to define capabilities
- GPS III satellite launches to begin in 2012 timeframe



GPS Modernization Schedule

Activity	Implementation Date FY05 PB
SA set to zero	May 2000
GPS IIR-M Enhancements <ul style="list-style-type: none"> - New L2 Civil (L2C) Signal - M-code on L1 & L2 	1 st launch Feb 2005
GPS IIF Enhancements <ul style="list-style-type: none"> - New L2 Civil (L2C) Signal - M-code on L1 & L2 - L5 	1 st launch 2006
GPS III Enhancements <ul style="list-style-type: none"> - New L2 Civil (L2C) Signal - M-code on L1 & L2 with greater power - L5 - Future Capabilities 	1 st launch ~ 2012
OCS Enhancements	On-going

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GPS STEWARDSHIP FUND

- **Selection criteria for Agency-proposed projects:**
 - **Clear, national-level benefit**
 - **Priority to projects reflecting dual-use nature of GPS**
 - **Expenditures must fall outside normal agency budgets and benefit two or more IGEB member agencies**
 - **Agency Cost Sharing is encouraged**

Stewardship Funds Currently Support Several Projects Important to GPS Modernization



L1 Civil Signal Modernization

- **Joint military and civil study to assess the benefits of an additional civil signal at L1, known as **L1C****
 - L1 C/A will continue to transmit indefinitely
- **Outreach to GPS community to determine needs and requirements**
 - Feedback will be documented and form basis of signal design
- **Potential benefits are significant**
 - Increased robustness and potentially accuracy for civil users
 - Complementary to modernized GPS L2C and L5 signals
 - Compatible with next generation Galileo and QZSS

For additional information contact: L1C_GPS@USGS.gov



Civil GPS PNT Analysis of Alternatives (AoA)

- **In general – an AoA provides a reliable, objective assessment of the options for meeting user needs**
- **For GPS – will provide the tools to effectively identify and validate GPS requirements vs. PNT requirements**
 - **Effectiveness and Cost Analysis to compare the allocation of systems**
 - **GPS Signal from Space**
 - **Augmentations**
 - **User Equipment**
 - **Other Systems or Operational Procedures**



Civil Signal Monitoring

- **Global Dual Monitoring System (GDMS) Study**
 - Explore use of existing resources
 - Identify Performance Measures
 - Develop architecture and algorithms
 - Demonstrate data collection and processing
- **Modernized Monitor Station Receiver Element (MMSRE) – civil component**
 - First Full Monitoring of Civil Signals by the GPS Master Control Station from 5 Air Force Monitoring Stations
 - Improved Civil Signal Accuracy
- **GDGPS**
 - Explore the feasibility of using the NASA differential GPS network (a subset of the IGS network) as an integrity monitor

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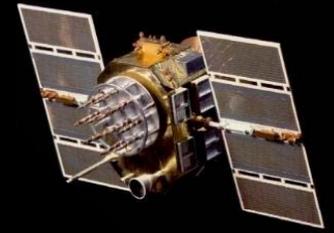
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SUMMARY

- **Consistent GPS Policy** (Executive and Legislative) combined with a dual-service system exceeding performance standards has resulted in tremendous benefits to civilian and military users
 - The IGEB, established by **Presidential Policy** and recognized by **Public Law** has been meeting since 1997
 - Underlying groups and processes have been formalized in order to **manage interagency issues** without continuous senior-level intervention
 - **Civil agencies** participate in Department of Defense acquisition, system development and requirements/capabilities processes
- **Modernization** is underway to steadily improve both civil and military services
 - **New signals** are the primary focus of civil GPS modernization
 - Several **IGEB-funded projects** are underway that should make important contributions to modernization



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